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Emotion Detection using Facial Recognition Technique

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ABSTRACT

Emotion recognition based on facial expression is an intriguing research field, which has been presented and applied in various spheres such as safety, health and in human machine interfaces. Researchers in this field are keen in developing techniques that can prove to be an aid to interpret, decode facial expressions and then extract these features in order to achieve a better prediction by the computer. With advancements in deep learning, the different types of prospects of this technique are exploited to achieve a better performance. We spotlight these contributions, the architecture and the databases used and present the progress made by comparing the proposed methods and the results obtained. The interest of this paper is to guide the technology enthusiasts by reviewing recent works and providing insights to make improvements to this field.

Keywords : Emotion Detection, Machine Learning, Facial Expressions, Deep Learning, Convolutional Neural Network

I. INTRODUCTION

Emotion plays a crucial role in a person's physical and mental wellbeing. A human being is a pool of emotions with varied kinds of emotions present inside a person. Facial recognition has been a most sought after technique in today's era . This technique is being used in many firms, in the field of robotics ,educational institutions , hospitals to name a few. There are numerous methods that can be implemented to inspect the recognition of human expressions, ranging from facial expressions, body posture, voice tone etc.

This paper basically reviews various facial extraction features, emotional databases, classifier algorithms and so on. The general overview of the paper is as follows. The paper describes background information about expression recognition, emotion recognition systems and applications of emotion recognition systems. It also explains the Feature selection methods and Image optimization. Further Sections compares various Facial emotional databases available.various classifier algorithms for classifying images are also been analysed according to the expression identified. The paper has been concluded in the final Section with our observations done throughout the process.

II. FACIAL RECOGNITION

Face Detection is the first and essential step for face recognition, and it is used to detect faces in the images. It is a part of object detection and can be used

in many areas such as security, bio-metrics, law enforcement, entertainment, personal safety, etc.
Facial Expression Recognition has numerous applications such as detection of mental disorders, human behavior understanding and social interaction, to name a few. We use our facial expressions to provide important communications and also express our emotions during social interaction.

Expressions detection through visual analysis based methods is still an intriguing research area due to the fact that expression can be emitted by a face without any sound. Vision based methods are generally divided into

a. Pre-processing,
b. Feature Extraction
c. Expression classification.

Some preprocessing stages like face detection and normalization are performed on the input image in the first step. After the face detection stage, the second and the most crucial step is to extract the face features from the input image. The correctness of any expression recognition system is greatly influenced by many factors such as:how accurately features are extracted from a given image. Although geometric-based features further depend upon illumination and other face variation, tracking of the facial salient points is very hard. Change in Appearance of the face are utilized for appearance features extraction. One problem that is associated with the appearance extraction is that it produces an extremely large number of features.

CNN (Convolutional Neural Networks)

With the development of convolutional neural networks, the achievements made in the field of research are tremendous. In order to improve the training performance, an effective method is to reduce the number of learning parameters. This can be achieved by convolution of the spatial relationship of the neural network. In Convolutional neural networks, the network structure is proposed, which reduces the input data pretreatment. In the structure of convolution neural networks, the input data is taken from the initial input layer, by processing each layer at each level starting from the most basic one , and then into the other hierarchy, each layer has a convolution kernel to obtain the most significant data characteristics.

CNN consists of neurons with learnable weights and biases. Each specific neuron receives numerous inputs and then takes a weighted sum over them, where it passes it through an activation function and responds back with an output

To recognize a particular person in an image or video by matching with the database.

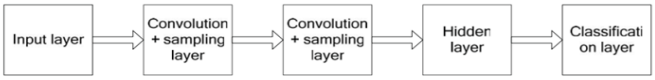


Fig 1. CNN Structure Diagram

Facial landmarks

Facial landmarks are a set of key points on human face images. The points are defined by their (x,y) coordinates on the image. These points are used to locate and represent salient regions of the face, such as eyes, eyebrows, nose, mouth and jawline. To identify the face structure in an image or video using landmark points on the face like eyes, nose, mouth, etc.

Emotion Factor

The emotions of the person is detected through each frame of the webcam feed. The region of image containing the face is resized and is passed as input to the CNN. The network outputs a list of softmax scores for the below classified emotions. The emotion with

the maximum score is displayed on the screen. If there are several people then each of the samples is classified according to the score and then represented with the emotion related to it.

The classified categories are as follows :

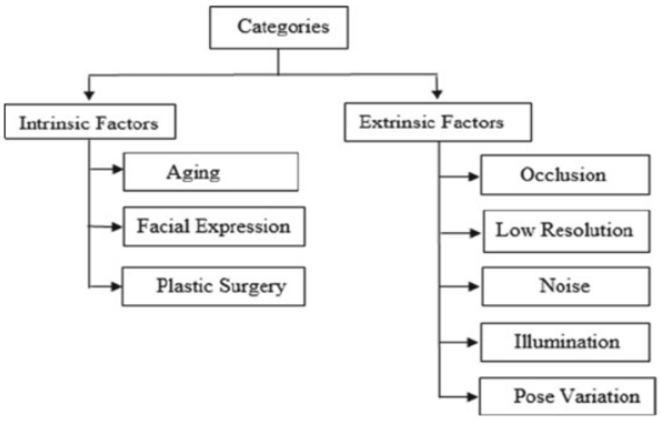
1) Sad
2) Happy
3) Neutral
4) Angry
5) Surprise

Facial landmarks classification

A convolutional neural network was used in our system to obtain improved facial emotion detection as it is applied to other computer fields such as face recognition and object detection .In addition, predictions are based on information given at a particular time of input. This setup takes an input image and attempts to predict the output emotion. It has eight stages before giving out an output, including convolutions, pooling and fully connected layers with rectified linear unit (ReLU) operations, which preserve good quality while making convergence much faster. The number of filters used are generally 32, 64, and 128 which had a filter size of 5×5 for the convolutional layers, and the number of output nodes in the fully connected layer was 6 .

III. FACTORS AFFECTING FACIAL RECOGNITION

It has been found that the factors that degrade the accuracy of the face recognition systems are: occlusion, low resolution, noise, illumination, pose variation, expressions, aging, and plastic surgery. on the basis of which we have classified it into 2 categories - intrinsic categories and extrinsic factors.



Low Resolution

The samples which are processed may have issues with resolution. So the detection of emotion through the images can reduce the accuracy by almost upto 60 percent.The other alternative is to compare low resolution image with a high resolution image is a challenging.The solution to this can be a variety of sample images of the same face taken. This not only increases the amount of accuracy but also helps the model to more accurately detect the emotion of the person.

Face Masks:

The methodologies used for facial detection systems like emotion recognition, trust attribution and re-identification of faces differ in three popular situations in today's time: when faces are seen without mask; with a typical medical facemask; and with a transparent facemask restoring visual access to the mouth region. The results of varied studies show that, in contrast to straightforward medical face masks, transparent masks significantly pose a less problem in capability to acknowledge emotional expressions. Remarkably, while transparent masks (unlike standard masks) don't enervate emotion recognition and trust attribution, but,they do enervate the next re-identification of the identical, unmasked, face.

The problems that masks create within the emotion detection process are that:Firstly, by making the mouth invisible, facemasks potentially suppress the potential to perceive a good deal of social information which are of utmost relevance for everyday interactions across several social contexts. The mask interferes with the popularity of its bearer's state of emotion. By making emotional displays harder to check, face masks also compromise facial mimicry and behavioral synchrony which, in turn, imbues empathy and playful interactions.

Emotion recognition is an essential element of detecting facial emotions and the person's distress. Emotional expressions were posed while wearing either (1) standard masks occluding the complete mouth region (SM), (2) transparent masks restoring visual access to the mouth region (TM), or (3) no masks.

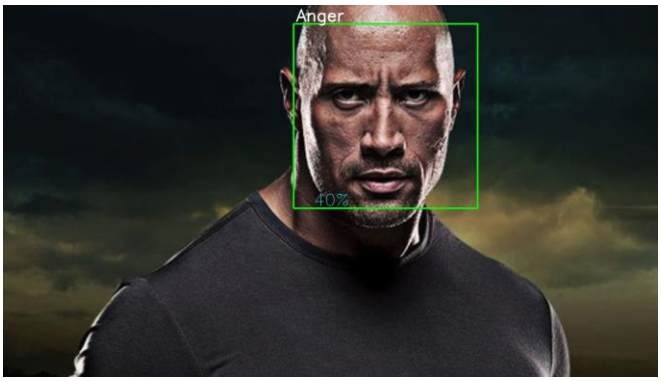
The mask can prevent the reading of a person's expression. In particular, while standard masks prevent the detection of facial displays, transparent masks which facilitate visual access to the mouth region— and hence having virtually no effects on emotion recognition, result in results that are love those obtained when the face is fully visible. this effect is especially strong within the case of the three emotional expressions, but is virtually absent within the case of the neutral expression, which may well be correctly recognized altogether conditions

Another interesting finding in various studies is that masks make no difference for identifying that a face is neutral with relevancy and emotion. The emotional neutrality of a face is often easily decoded by the eyes41.On a more practical side, transparent masks almost entirely avoid the "emotional screening" effect of ordinary masks. Indeed, the accuracy of emotion recognition of faces wearing transparent masks is sort of reminiscent of that obtained with unmasked faces, and significantly better than that obtained with faces wearing standard masks, for all kinds of emotions.

IV. IMPLEMENTATION

We have taken a dataset consisting of numerous images of humans showing different emotions. We first pre-process and cleaned the data. The data is then bifurcated into various groups on the basis of the emotions they depicted.

Using these groups we have trained the model to identify the emotions present in the images which are input by the user.



The depicted emotion is shown by a green line which identifies the human face and a notation of the emotion associated with it.

V. CONCLUSION

In the last two decades, facial recognition technology has come a long way. Today, machines can automatically verify identity information for secure transactions, surveillance and security tasks, and building access control. These applications typically operate in a controlled environment, and recognition algorithms can use environmental constraints to achieve high recognition accuracy. However, the next generation of facial recognition systems will be widely used in smart environments.

To achieve this goal, computers must be able to reliably recognize nearby people in a way that naturally conforms to normal patterns of human interaction. They should not require special interactions, and should stick to human intuitions about when recognition is possible. This means that the smart environment of the future should use the same model as humans and have roughly the same limitations.

These goals now appear to be achievable, but a lot of research is still needed to use information from a single or multiple modes to make people identification technology work reliably under widely varying conditions.

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